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ABSTRACT

The roots of technical writing are deeply planted in the field of mining engineering, with its emphasis on economics, value, and social stability. In the mid-16th century, Georgius Agricola published "De Re Metallica," a compilation of knowledge about mining and metallurgy. Agricola sought to explain the reasoning behind some of the recipes for manipulating nature that he had taken from textual sources. In the 16th century, magic included all practices based on experiential knowledge which sought to manipulate nature. According to this formulation, Hermetic knowledge contained in books of secrets certainly was magical and knowledge about the physical world gained from practical experience, like that of mining and metallurgy, could also be considered magical. Agricola's introduction to "De Re Metallica" also worked to differentiate his text from books of secrets. Instead of recounting how the information contained in the book was revealed to him in a personal encounter with a god--a generic literary device for giving books of secrets their authority--Agricola built the authority for his text on his own experience and that of people to whom he had talked and whose texts he had read. Agricola was one in a string of writers who compiled useful information into handbooks after the development of the printing press made these compilations profitable for press owners, publishers, and writers. Many people benefitted from such knowledge. (Contains 6 references.) (CR)

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Notes from Underground: Technical Writing and the Hermetic Tradition in Agricola's *De Re Metallica*

The roots of technical writing are deeply planted in the field of mining engineering, with its emphasis on economics, value, and social stability. In the tradition of Francis Bacon's public science, technical writing participates in a social system that was established to democratize knowledge, taking experiential secrets for manipulating nature out of the realm of magic and making them legitimate subjects for scientific experimentation.

Francis Bacon read and was influenced by the 16th century works of Georgius Agricola (Farrington 33 ff.). In these works, such as *De Ortu et Causis Subterranеorum* (1546) and *De Re Metallica* (1556), Agricola argued for a natural philosophy based on experience with and observation of the things of the world. Agricola's compilations of practical information represented a departure from the types of knowledge that had been legitimated through the then-dominant scholastic tradition, i.e., knowledge which tended to be speculative and based upon rigid tenets of Aristotlean syllogistic logic.

For the scholastics who followed Aristotle's teachings, science was concerned with explaining the reasons for ordinary, natural events. It was not concerned with the extraordinary, which was deemed to be the province of magic and the Hermetic books of secrets. Science was contained in scholarly texts and scientists developed theories and reasoning by consulting these texts, not by conducting experiments. Experimental—or experiential—knowledge was deemed the province of magic and was fit for the illiterate. In practice, scholars regularly carried out both textual and experimental work. But their textual science was presented in formal academic settings as legitimate knowledge while their experimental magic was reserved for private uses as non-legitimate knowledge.

De Re Metallica in its Cultural Context

In the mid-16th century, Georgius Agricola published *De Re Metallica*, a compilation of knowledge about mining and metallurgy. In his introduction, Agricola cited the many textual and extra-textual sources which he consulted in compiling his book. Agricola himself was skilled in the craft about which he wrote and he supplemented his own knowledge by reading other authors' works and talking with people who were knowledgeable in mining and metallurgy. In his approach to compiling the knowledge included in *De Re Metallica*, Agricola was typical of other encyclopedists in the Greek and Roman tradition. Yet in other ways, Agricola was like the popularizers of Hermetic secret lore (or magical knowledge) in 16th century Europe. He presented recipes for manipulating nature, just as previous authors of books

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of secrets had done. He included information about alchemy and elves in the mines, which was the province of magic. But Agricola extended the encyclopedic and secrets traditions, synthesizing them with experimental knowledge in his text on mining that was to have far-reaching influences.

In *De Re Metallica*, Agricola sought to explain the reasoning behind some of the recipes for manipulating nature that he had taken from textual sources. Unlike traditional scholastic texts, though, Agricola included Hermetic texts as sources for his speculative reasoning and he treated what scholastics would consider occult topics, such as magnetism, whose workings could not be seen. For example, in Book II of his work, Agricola presented lengthy information about using a divining twig to locate veins of ore. But in addition to simply telling how to use the divining rod, he explained the reasoning behind the twig's movement by discussing magnetism and idiosyncratic human properties:

> ... when one of the miners or some other person holds the twig in his hands, and it is not turned by the force of a vein, this is due to some peculiarity of the individual, which hinders and impedes the power of the vein, for since the power of the vein in turning and twisting the twig may be not unlike that of a magnet attracting and drawing iron toward itself, this hidden quality of a man weakens and breaks the force, just the same as garlic weakens and overcomes the strength of a magnet (39).

Here Agricola presented a recipe for using a divining rod based on occult magnetic principles, e.g., a "hidden quality of a man" can weaken or break the magnetic force; garlic weakens or breaks the magnetic force; a magnet draws iron toward itself; a person can use the magnetic force to find a vein of metal through the use of a divining rod. Agricola's work resembled the books of secrets in that his advice was in the form of a decontextualized recipe. Unlike books of secrets, however, Agricola related his recipe to Hermetic knowledge by discussing the place of occult knowledge in his 16th-century culture:

> Since this matter remains in dispute and causes much dissention amongst miners, I consider it ought to be examined on its own merits. The wizards ... seek for veins with a divining rod shaped like a fork; ... it is not the form of the twig that matters, but the wizard's incantations which it would not become me to repeat, neither do I wish to do so. The Ancients ... were also able to alter the forms of things by [the divining rod]; as when the magicians changed the rods of the Egyptians into serpents, as the writings of the Hebrews relate; and as in Homer, Minerva with a divining rod turned the aged Ulysses suddenly into a youth, and then restored him back again to old age; Circe also changed Ulysses' companions into beasts, but afterward gave them back again their human form; moreover by his rod, which was called 'Caduceus,' Mercury gave sleep to watchmen and awoke slumberers. Therefore it

> seems that the divining rod passed to the mines from its impure origin with the magicians. Then when good men shrank with horror from the incantations and rejected them, the twig was retained by the unsophisticated common miners, and in searching for new veins some traces of these ancient usages remain (40-41).

In this passage Agricola examined both the magical and practical uses of the divining rod, noting that the use of this occult instrument was in dispute "amongst miners." In this examination, Agricola sought to separate the magical history of the rod from its practical uses in mining. This separation was crucial to retaining the rod as an acceptable, respectable instrument of mining, since its magical history was caught up in theological and social contests.

In the 16th century, magic included all practices based on experiential knowledge which sought to manipulate nature. According to this formulation, Hermetic knowledge contained in books of secrets certainly was magical and knowledge about the physical world gained from practical experience—like that of mining and metallurgy—could also be considered magical. Thus, Agricola's entire subject matter in *De Re Metallica* verged on the magical. He definitely crossed over the line into magic, however, when he discussed occult subjects, such as magnetism and divining rods.

The problem Agricola faced in dealing with magical knowledge was that this type of knowledge bore the stigma of religious heresy—not to be taken lightly in the time of the Inquisition. Since the early sixth century after Augustine wrote *The City of* God (A.D. 426), magic was denounced as a form of idolatry because people practicing magic were in concert with demons.[1] According to this line of thinking, God intended nature's secrets to remain hidden from man. The story of Adam and Eve was an example of God's intended order of knowledge and secrets in the physical world, the violation of this order, and the tragic consequences of the violation. People who sought to manipulate nature through secret knowledge of magical practices threatened God's order. According to Bizzell and Herzberg, *The City of God* was written as a "comprehensive application of Christian ideas to the governance of the secular state" (382). Because this tract was concerned with social order, Augustine's stance on magic had social implications. As William Eamon argued, "Augustine's polemic against intellectual curiosity gained new relevance during the scholastic period, when reason reared its prideful head to challenge faith" (62). This challenge of magic and intellectual curiosity to religious authority and social order continued throughout the middle ages and into the 16th century when Agricola wrote *De Re Metallica*.

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[1] See William Eamon, Chapter 2 "Knowledge and Power" and Stuart Clark, "The Rational Witchfinder" for more complete discussions of the role of magic in relation to science and technology in medieval and Renaissance European cultures.

Separating the Occult from the Useful

In Agricola's time, engineers and practitioners of the mechanical arts had access to books of secrets containing magical recipes. Since the purpose of the magical knowledge—the manipulation of nature for practical ends—coincided with the purpose of engineering and mechanical arts, engineers and craftsmen found these books useful. According to William Eamon,

> Medieval engineers enthusiastically appropriated magic as a theoretical framework for technology. Indeed they regarded magic as technology's sister art. Not only did learned magic give technology a theoretical matrix, it served an important ideological function by promoting the image of the professional engineer as a magus who, with his inventions, manipulates nature's occult forces and gains mastery over the physical world. ... [For some engineers,] the usefulness of the occult sciences in this world overcame any consternation about the dangers it may have held for the soul in the next (69-71).

Some engineers may not have been concerned with their souls, but evidently Agricola was. By separating the divining rod's magical history from its practical utility, Agricola first conceded that the divining rod had an "impure origin with the magicians" who consorted with demons and threatened the religious and social order. But when he "examined [the use of the rod] on its own merits," Agricola argued that miners who were "unsophisticated" in the ways of magic could still make use of the rod for locating veins of ore. In other words, the rod could be used to locate ore even though miners did not rely on magic to make it work. Agricola clearly stated his stand against magic when he declined to repeat "the wizard's incantations" that people sophisticated in magic would use to make the divining rod work. In accomplishing this separation of an occult natural phenomenon, such as the use of the divining rod, from the realm of magic, Agricola prepared the way for considering magnetism and other natural phenomena as legitimate objects of utilitarian scientific study.

Creating a Place for Legitimate Experiential Knowledge

Agricola's introduction to *De Re Metallica* also worked to differentiate his text from books of secrets. Instead of recounting how the information contained in the book was revealed to him in a personal encounter with a god—a generic literary device for giving books of secrets their authority—Agricola built the authority for his text on his own experience and that of people to whom he had talked and whose texts he had read. The presumption here was that the information contained in other people's texts was based on their experience and Agricola included only that textual material which seemed plausible to him in light of his own experience and reasoning. In this respect, Agricola's authority was built in the encyclopedic tradition, and although he included alchemical information from Hermetic texts, he also discussed the questionable nature of this information:

> Whether they can do these things or not I cannot decide; but, seeing that so many writers assure us with all earnestness that they have reached that goal for which they aimed, it would seem that faith might be placed in them, yet also seeing that we do not read of any of them ever having become rich by this art, nor do we now see them growing rich, although so many nations everywhere have produced, and are producing, alchemists, and all of them are straining every nerve night and day to the end that they may heap a great quantity of gold and silver, I should say the matter is dubious (xxviii).

Agricola thus destabilized the information from books of secrets by undermining the authority of the books he cited. *De Re Metallica* resembled a book of secrets by addressing occult subject matter, but not by endorsing alchemy and magic. Agricola's final criterion for including occult knowledge was that he found it useful. In applying this experimental criterion and privileging first-hand information, while destabilizing the traditional repository for experimental knowledge (Hermetic books of secrets), Agricola began to reconstruct the place of experimental knowledge based on its utility.

From Secrets to Public Science

Agricola was one in a string of writers who compiled useful information into handbooks after the development of the printing press made these compilations profitable for press owners/ publishers and writers. With the popularization of this new type of handbook, many people could benefit from knowledge based both on ancient lore and personal experience. The experimental/experiential knowledge contained in these new handbooks, because it was separated from occult teachings, became more palatable and less heretical in a European culture influenced by Reformationist ideas of God and nature. In this setting, Francis Bacon brought together trends from the printing industry, popular handbook literature, religion, and statecraft to devise a plan for elevating the place of the mechanical arts within his culture and creating a popular project for using the mechanical arts for the betterment of general living conditions.[2] This plan has come down to the 20th century as inductive science. Bacon's full plan, however, was more comprehensive than simply a scientific method. It included social institutions and religious foundations, making science the vehicle for carrying out his social and religious project.

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[2] Farrington (33-34) makes a case for the fact that Francis Bacon not only read *De Re Metallica*, but was strongly influenced by this book.

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